CS 499 Capstone Module 3 Milestone Two

Southern New Hampshire University

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**Briefly describe the artifact. What is it? When was it created?**

The artifact that was chosen is from CS-330 Comp Graphic and Visualization. The object of the course was to take a 2D image (Fig 1) and make a 3D representation of it. The artifact was supposed to be the final project that was created using Microsoft Visual Studio (MVS). The language that I used to during this course was C++. The artifact that I am working with was created in April 2023.

A picture containing text, sunset, orange, colorful

Description automatically generated

Figure 1

**Justify the inclusion of the artifact in your ePortfolio. Why did you select this item?**

The reason why I chose this artifact is because I did not finish the final assignment completely. After the course I realized that OpenGL is widely used in industries such as gaming, computer-aided design, scientific visualization, and simulations. Working on an OpenGL project allowed me to gain practical experience. I currently work for a DoD program, and they have an office of developers who designs visual objects for the DoD. I would like to hopefully seek a job opportunity with that department to showcase what I can bring to the table.

**What specific components of the artifact showcase your skills and abilities in software development?**

During this enhancement development I showcased the following skills:

Advanced Texture Mapping: By refining the texture mapping process, I showcased my ability to work with graphics libraries and effectively apply textures to 3D objects. This skill is essential for creating visually engaging 3D graphics. Added 3 GLuint operations (Graphics Library Unsigned interger) to bind the objects. Also updated the Comments for the code to be readable.

A screen shot of a computer program

Description automatically generated

User Interaction Design: Improving camera control required a strong understanding of user experience design and interactive systems. This skill is vital for creating engaging and user-friendly software.

A screen shot of a computer program

Description automatically generated

Mathematics for Graphics: Graphics programming often requires a strong understanding of linear algebra and geometry. Applying math to vectors, matrices, and mathematical transformations are used to manipulate 3D objects and camera views. This skill is key to enhancing objects from 2D. In the Enhancement I used math to rotate one of the pyramid.

A screenshot of a computer

Description automatically generated

**How was the artifact improved?**

In improving the artifact, I focused on Category One: The Software design and engineering guideline. The artifact took on a life of its own, as you look at what was submitted for the last project. The code was optimized for better performance:

1. Adding texture: For the enhancement, I was only able to add multiple textures to the pyramids, by identifying an issue with the shader program. Shaders are essential for manipulating and enhancing 3D images. If you notice in Fig 2, I could not get the pyramids to come together and their appearance remained white. In the enhancement, I was able to work on the design by fixing the texture.

* As outlined in Module One this meets the #4 Course Outcome: Demonstrate an ability to use well-founded and innovative techniques, skills, and tools in computing practices for the purpose of implementing computer solutions that deliver value and accomplish industry-specific goals.

1. Creativity and Artistic Design: The Enhancement has a better visual appearance compared to the original submitted artifact. In comparing to the results, the enhanced artifact shows the two pyramids coming together to form a single floating object over a dangerous landscape. There is a moon in the distant background, casting a light on the pyramid, the land, and the trees. There is a dark and scary black forest that seems to be the only living thing.

* The artifact improved by adding a sphere shape for the moon to provide a lighting effect. One of the pyramids was manipulated by rotating it 180° upside-down to be the pointed bottom of the top pyramid. 6 Cone shapes were added to give the flat plane some texture. When manipulating the shapes or the location of the of the objects, trigonometric functions are used to determine the new positions of vertices. Trigonometric functions such as sine and cosine are used in calculating rotations and angles.
* As outlined in Module One this meets the #3 Course Outcome: Design and evaluate computing solutions that solve a given problem using algorithmic principles and computer science practices and standards appropriate to its solution, while managing the trade-offs involved in design choices.

1. UI/UX Design: The user experience has been improved, the refinement of the camera control has been enhanced by incorporating the up and down pitches by pressing the “Q” and “E” button. This improved feature allows for smoother and more intuitive camera movements, enhancing the overall user experience within the 3D environment.

As outlined in Module One this meets the #2 Course Outcome: Design, develop, and deliver professional-quality oral, written, and visual communications that are coherent, technically sound, and appropriately adapted to specific audiences and contexts.

**Did you meet the course objectives you planned to meet with this enhancement in Module One?**

I met the objectives I had planned since Module One with this enhancement. In addition to the improvements in texture mapping and camera control, I have successfully implemented enhanced lighting effects as part of this enhancement milestone. The addition of lighting not only enhances the visual appeal of the 3D scene but also contributes to a more immersive and realistic experience for users.

**Do you have any updates to your outcome-coverage plans?**

For this category, I did run into a couple of snags that made the code difficult to run. When I applied the texture the first time, I noticed there was something off when I provided the location of the file. Adding additional lines of code increased the size of the of the file. This will impact the next Enhancement Two: Algorithms and Data Structure. In this phase of the project, I have focused on enhancing the algorithms and data structures employed within the 3D representation project. The updates are to improve the efficiency, performance, and overall quality of the software. During this enhancement, I noticed that I will have adjust my plans accordingly.

**Reflect on the process of enhancing and/or modifying the artifact. What did you learn as you were creating it and improving it? What challenges did you face?**

During this enhancement, I can say that enhancing a 3D image using Visual Studio OpenGL can be a rewarding but challenging process. During the process I gained a deeper understanding of OpenGL and computer graphics in general. There is a lot of trial and error. This is a lot of learning, but it can be rewarding once you accomplish what you are trying to do. I also relied on some OpenGL documentation and online forums or communities like Stack Overflow. I searched for solutions to common OpenGL issues and experiences of others who have faced similar challenges.